FOREST PRODUCTS
Project Fact Sheet

LASER SENSORS FOR ON-LINE MONITORING OF CARRYOVER IN RECOVERY BOILERS

BENEFITS

- Provides information relevant to boiler design and operation.
- Determines the role of intermediate size and char carryover in convection pass deposition and boiler plugging.
- Contributes a means of increasing energy efficiency, pulping capability and production while reducing problems associated with boiler cloggage.
- Improves mill productivity by minimizing deposits and extending time between water washes.
- Decreases recovery boiler operation costs.

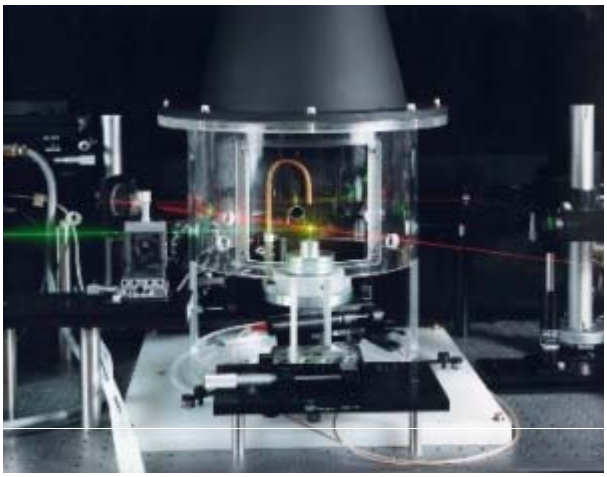
Laser Technology will Determine Properties of Carryover Particles

Intermediate size particles (ISPs) and carryover particles in the flow entering the convection pass are believed to be an important contributor to boiler tube deposition. Deposit formation reduces the energy efficiency of recovery boilers, limits the pulping capacity in kraft mills, causes plugs, and reduces boiler capacity. Since there is a possibility that ISPs and carryover particles can be controlled by a number of adjustable process variables, accurate measurements of particle size, concentration, and chemical composition could provide important information for both recovery boiler design and operation.

Two laser-based optical diagnostic techniques previously developed by Sandia National Laboratories and Process Metrix LLC are being modified for in situ measurements of ISPs and carryover particles in recovery boilers under a DOE/OIT and AF&PA sponsored research project. Modifications to these developed technologies will provide real-time information on particle size distribution, mass loading and chemical composition of ISPs and carryover particles.

APPLICATIONS

This project will provide an understanding of the relationship between intermediate size, carryover particles, and recovery boiler deposition that the industry can apply to current process variables (such as liquor quality and the furnace air distribution). Creation of a unified probe design with both laser techniques could also lead to the development of a commercial ISP/carryover analyzer that could control recovery boilers as an on-line sensor. A successfully demonstrated sensor technology is expected to be rapidly commercialized.



Laboratory LIBS setup

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ENERGY EFFICIENCY AND RENEWABLE ENERGY • U.S. DEPARTMENT OF ENERGY

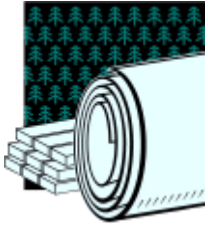
PROJECT DESCRIPTION

Goal: To develop and apply two in situ, laser-based techniques in the upper furnace and convection pass regions of recovery boilers in order to measure the size, concentration, and chemical composition of carryover particles.

This two year project will rely on advanced optical diagnostics: a Particle-Counter-Sizer-Velocimeter Probe (PCSV-P), developed by Process Metrix to measure the physical properties of entrained particles; and Laser-Induced Breakdown Spectroscopy (LIBS), used by Sandia to measure the chemical composition of particles. Construction, modification, and demonstration of these two technologies for ISP and carryover monitoring in recovery boilers relies heavily on cross-talk, co-development, and go/no-go decision points.

PROGRESS & MILESTONES

- A kickoff meeting involving Process Metrix, Sandia, and Georgia-Pacific representatives discussed criteria for choosing an appropriate boiler for ISP/carryover particle testing, probe water-cooling, and sootblower interference issues.
- Laboratory studies of LIBS detection of chlorine, sulfur, and carbon have been conducted by Sandia (detection of sodium and potassium well established).
- A dual-spectrometer LIBS detection scheme has been implemented, allowing for simultaneous measurement of at least two chemical elements.
- A long-extension, direct fiber-detect LIBS probe has been designed for use with an existing water jacket for recovery boiler measurements.
- Process Metrix reviewed PCSV probe design, concentrating on reducing the relative sensitivity to laser scattering from fume particles.
- Use of a single laser beam and reducing the PCSV detection aperture was calculated to significantly improve discrimination against fume scattering; implementation and testing with resuspended fly ash from the Weyerhaeuser Longview boiler verified favorable performance of new design.
- A preliminary series of measurements has been performed from mid-superheater to the economizer of the Longview boiler using the modified PCSV design, which allows measurements of particles from 5-100 m. The data show that few ISPs or carryover particles are present at these measurement locations.
- In the near future, the modified PCSV probe will be employed at the entrance to the superheater in the Longview boiler and a post-water wash survey will be performed at the downstream measurement ports. The new LIBS probe will also be employed shortly at the Longview boiler.



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